Letters to the Editor.

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Organisation of Scientific Work.

I HAVE only recently seen the article in NATURE of February 19 and the correspondence so unanimously supporting the view that the present decentralised system of team work by experts in different branches of science in agricultural, forestry, and medical research institutes is greatly superior to the proposed centralisation in distant Simla of each separate science—chemistry, botany, etc.—under directors of research with autocratic powers to decide what each original worker in his branch throughout India shall investigate and publish; for it is clearly impossible in these days for one man to be sufficiently conversant with each special division of his science adequately to fulfil such a stupendous task. I desire to associate myself with that view, which may be illustrated by my experience in organising the Calcutta School of Tropical Medicine, shortly to be opened, for which I have just obtained endowments from two successful European and Parsi business men for a whole-time biochemist, in addition to two other chemists for the analysis of indigenous drugs and of food and water respectively, all three of whom will aid nine medical research investigators in team work at important medical problems under a medical director. Could anyone contend that these very specialised chemists would be better controlled by a purely chemical director a thousand miles away in Simla, who could know nothing of the medical problems they will investigate?

On the other hand, if the Government of India is to provide the large sums urgently required for the further development of scientific research in India, it will require some organisation to co-ordinate and report on the work it will be financing. May it not learn a lesson from the Medical Research Committee of eminent medical men of science, which is wisely utilising the large sums supplied by the British Government in assisting the investigations of university and medical-school workers with established reputations and with a minimum amount of interference? A very similar and successful organisation was set up in India when the late Sir Pardey Lukis persuaded the Government of India to hand over five lakhs (some 50,000*l.*) a year to the Indian Research Association, administered by a governing body on which the medical members, through their special knowledge of the subject, exercise a preponderating influence; while I have recently obtained a purely medical governing body to administer the endowments of the Calcutta School of Tropical Medicine with an income of some 11,000*l.* a year, which I have been fortunate enough to raise to provide both men and apparatus without the long delays, usually of several years' duration, involved in obtaining the sanction of the Government of India and of the Secretary of State for new posts.

This plan has thus already proved its value and is capable of extension, while boards composed of a number of men of science of high standing will command much greater confidence than an autocratic director of research. The nucleus of such a body already exists in the Board of Scientific Control, which meets twice a year in Delhi and Simla, and might with greater advantage hold its principal meeting coincidently with the Indian Science Congress in one of the large centres of research. At a meeting in Delhi in December, 1918, I advocated, in place of an autocratic director of medical research, that an inspector of research might be appointed, who would not attempt the invidious task of laying down what each research worker should investigate and publish, but would visit different research laboratories and consult with their respective directors or councils regarding the financial and other needs of the institutes, and help to co-ordinate the work in different parts of India to prevent waste through overlapping. The recent correspondence in NATURE confirms me in that solution of the difficulty, and I venture to think that in some such ways as I have suggested the established advantages of the present decentralised system may be retained and strengthened by greater and more elastic financial aid, and be better co-ordinated, without introducing the highly objectionable autocratic and distant centralised control of the proposals now before the Indian Government to which you have directed such timely attention.

LEONARD ROGERS.

South Devon, April 29.

The Small Islands of Almost-Atolls.

THE familiar inductive series of fringing reefs, barrier reefs, and atolls may be further subdivided so as to contain six members: Normal fringing reefs, offshore fringing reefs, narrow-lagoon barrier reefs, broad-lagoon barrier reefs, almost-atolls, and atolls. Almost-atolls, or atoll-like reefs encircling lagoons in which one or several small islands rise, are of interest as affording a critical test of certain competing coral-reef theories, as follows: Murray's theory of outgrowing reefs around still standing islands explains a completed atoll by supposing that the original volcanic island is slowly worn down as the encircling reef grows outward and the lagoon is excavated behind the growing reef by solution, the degraded central island eventually disappearing in a way not clearly explained, perhaps by outwash of its detritus from the lagoon by currents which are fed by the influx of surf over the windward reef and discharged by outflow through passes in the leeward reef. Under this theory the small island of an almost-atoll would be a nearly worn-down central island, which would exhibit rolling hills of low relief surrounded by delta flats; or in a later stage, after the delta deposits had been swept away, the low hills of the vanishing island would be encroached upon by the lagoon waves and cut back in low bluffs fronted by low-tide rock platforms that gradually deepen into the lagoon.

According to Daly's Glacial-control theory, atoll reefs are built up from the margin of platforms abraded by the waves of the lowered Glacial ocean across still standing islands that had been previously worn down to low relief by long-continued normal erosion, the reefs being built up as the ocean rises in post-Glacial time. Under this theory an almost destroyed central island would have a surface of rolling hills, cut back by cliffs which would now—except for fringing reefs that may border them—plunge into the lagoon waters to a depth of twenty or more fathoms. This inference is well supported by the occurrence of strongly clift islands surmounting submarine banks of moderate depth in the extra-tropical seas. According to Darwin's theory of up-growing reefs on intermittently subsiding foundations—submergence by subsidence being faster than erosional degradation—atolls are produced when the central island of an up-growing barrier reef has sunk out of sight. Under this theory the lagoon of an

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almost-atoll would contain one or several nearly submerged islands of mountainous or mountain-top form.

The characteristics of the small islands of hypothetical almost-atolls, as thus deduced from several theories of coral reefs, may be confronted with the appropriate facts as represented in five actual almost-atolls: The Hermit Islands, in the Admiralty group north of New Guinea; Truk or Hogoleu, in the Caroline Islands; Budd Reef, in north-eastern Fiji; the Great Astrolabe Reef, in south-western Fiji; and Mangareva or the Gambier Islands, south of the Paumotus. The Hermit Islands are enclosed by a reef about 12 miles in diameter; the largest of the islands is 3 miles long and more than 3000 ft. in height. The encircling reef of Truk is about 30 miles in diameter, and encloses some twenty small islands; the largest measures 6 by 3 miles, and several of the larger ones are from 1000 ft. to 1300 ft. high; the smaller ones rise from 20 ft. to 300 ft. Budd Reef measures 12 miles in its longest diameter; three small islands, each less than a mile across, rise from 280 ft. to 480 ft. near the lagoon centre; a small horseshoe crater island, a mile in diameter and 590 ft. high, near the north-eastern angle of the enclosing reef, appears to be of much more recent origin than its neighbours, and does not bear on the problem here considered. The Great Astrolabe Reef makes an oval loop, 6 miles wide by 10 miles long, around a lagoon containing nine small islands; it is not properly an almost-atoll reef, for on the south it continues a long distance around the four-mile island of Ono and the thirty-mile island of Kandavu. However, the small islands that its northern loop surrounds are typical residuals; the largest is scarcely a mile in length, the highest rises 460 ft.; all are of rounded, mountain-top form, their small spurs being a little cut back by shore-line cliffs, which rise from low-tide rock platforms and do not plunge into deep water. Moreover, a triangular space defined by three of the islands, a mile and a half on its open sides, has the same depth of from 17 to 20 fathoms that prevails between the islands and the barrier reef; and this is beyond explanation by the Glacial-control theory. Gambier Reef is from 12 to 15 miles across; the enclosed islands are eight in number, and the largest of them measures 4 by 2 miles and has a height of 1300 ft. Dana wrote of the larger of these islands: "The very features of the coast—the deep indentations—are sufficient evidence of subsidence to one who has studied the character of the Pacific islands; for these indentations correspond to valleys or gorges formed by denudation during a long period while the island stood above the sea" ("On Coral Reefs and Islands," 1853, p. 95). Within the polygon defined by several of these islands two soundings give depths of 38 fathoms, while the lagoon outside the polygon has no depths so great.

All these almost-atoll islands are of mountainous or mountain-top form; they appear to be residuals of originally larger islands, much reduced by sub-aerial erosion and now isolated by submergence. The smaller ones are mere summits, too small to show embayed valleys; the larger ones have somewhat embayed shore-lines, which would, according to the best accounts that I can gather, be more strongly embayed if the deltas that now partly occupy the bays were removed. None of the islands are described as strongly clift, like those of the extra-tropical seas, although some headlands are a little cut back in low bluffs fronted by low-tide rock platforms, evidently the work of the lagoon waves at present sea-level. It thus appears that the small islands of actual almost-atolls are excellent counterparts of the mountainous or mountain-top islands of hypothetical almost-atolls deduced as the necessary consequences of Darwin's theory, but such islands cannot be accounted for by either Murray's or Daly's theory.

The attention of European men of science has been so largely withdrawn from the study of coral reefs during the last thirty years that the coral-reef problem now has scarcely a hearing among them. It is to be hoped that, with the acquisition of the numerous islands and reefs of northern and eastern New Guinea with the neighbouring reef-encircled islands by Australia, the old problem may be taken up again by the explorers and investigators of that remarkable region. The Louisiade group in particular deserves attention. The present communication suggests some of the newer aspects of coral-reef study, which, along with the embayments of reef-encircled islands and the unconformable contacts of fringing and elevated reefs with their foundations (see "The Geological Aspects of the Coral-reef Problem," *Science Progress*, xiii., 1919, pp. 420–44), must be taken into account for the future. All considered together, these newer aspects go far towards restoring confidence in Darwin's theory, which between 1880 and 1910 was so unreasonably discarded by many writers. The theory needs subordinate modification by the addition of changes of ocean-level during the Glacial period, to which Daly has so justly directed attention; but those changes acting alone would, whenever they occurred, produce emergences or submergences everywhere alike in their moderate amount, their slow rate, and their Pleistocene date; while all the reef-encircled islands that have yet been studied—as, for example, in Foye's "Geological Observations in Fiji" (Proc. Amer. Acad. of Arts and Sci., liv., 1918, pp. 1–145)—testify to submergences and emergences at dates that are frequently unlike from place to place, and of amounts that are frequently much in excess of the most liberal estimates of Glacial changes in ocean-level. Such submergences and emergences are, therefore, to be explained by local movements of subsidence or upheaval in the islands concerned. As reef-growth has been associated chiefly with the various movements of subsidence, reinforced recently by rise of ocean-level, Darwin's theory subordinately modified is thereby supported. W. M. DAVIS.

Harvard University, Cambridge, Mass.,
March.

Scientific Apparatus from Abroad.

THERE is one aspect of the proposed "anti-dumping" legislation to which I should like to direct attention.

While there is much scientific apparatus made in the British Isles of a quality at least as good as that imported, it is, unfortunately, very costly. But there are also many articles which our manufacturers have not yet learned to produce in anything like a satisfactory quality. The result of restricting the import of good articles by a heavy duty would be to compel scientific workers to use home-made goods. There would be no hardship if these goods were satisfactory. But such is by no means always the case, and we are then penalised by waste of time and frequent loss of experimental results. Moreover, if inferior goods obtain a sale by methods of this kind, no inducement is given to the makers to improve the quality.

I am aware that I may be called a doctrinaire Free Trader, but it seems to me to be a far more reasonable procedure to allow free import of such apparatus *until* equally good material is to be had cheaply at home. In the meantime, our manufacturers should,

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